

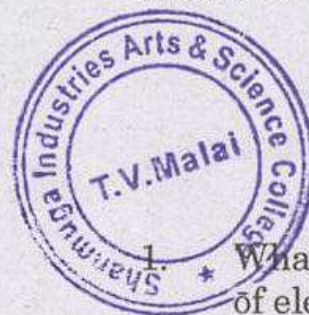
18. Describe the behavior of electrodes at equilibrium and under applied over potential.
 19. Discuss the evolution of oxygen and hydrogen at different pH values, with a focus on Pourbaix diagrams and the concept of overvoltage.
 20. Discuss the classification and working principle of a high-temperature fuel cell. Explain their advantages and disadvantages.
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NOVEMBER/DECEMBER 2025

23PECH14A — ELECTROCHEMISTRY

Time : Three hours

Maximum : 75 marks



SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. What are the limitations of the Arrhenius theory of electrolytic dissociation?
2. Define ionic activity and mean ionic activity.
3. What is the evidence for the existence of an electrical double layer at an electrode-electrolyte interface?
4. Distinguish between a polarizable and a non-polarizable electrode interface.
5. Define standard electrode potential.
6. State the significance of the symmetry factor (α) in the Butler-Volmer equation.
7. What is meant by stoichiometric number?

8. What is a Pourbaix diagram?
9. Define polarography
10. What is the primary mechanism of energy storage in an electrochemical capacitor?

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) Describe the deviation from ideal behavior for electrolyte solutions. How is this accounted for?

Or

- (b) Explain the concept of mean ionic activity and mean ionic activity coefficient. Why are these concepts necessary?

12. (a) Explain the concept of an electrical double layer at an electrode-electrolyte interface and provide experimental evidence for its existence.

Or

- (b) Describe the electro-kinetic phenomena and explain the concepts of electrophoresis and electro-osmosis.

13. (a) Explain the concept of exchange current density and net current density. How are they related to the over potential?

Or

- (b) Write about Tafel equations and Tafel plots.

14. (a) Describe the different types of overpotentials: activation, concentration, and resistance.

Or

- (b) Discuss the characteristics of the Butler-Volmer equation for a multi-step reaction and the role of the rate-determining step.

15. (a) Discuss the principle and applications of cyclic voltammetry.

Or

- (b) Explain classification of fuel cells.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Derive the Debye-Huckel limiting law for the activity coefficient of a strong electrolyte and discuss its modifications and applications.
17. Explain the concept of electrocapillary phenomena and its relation to the electrical double layer.

